

Abstract

In this work, two parts were studied: the effectiveness of corrosion protection of three pyridinium salts on steel (API 5L Gr.B) in a 0.5M H₂SO₄ solution. Gravimetric and electrochemical methods were used. We conducted investigations at different concentrations of the studied inhibitors and at the temperature of the experiment. The values of (IE%) determined from EIS of these inhibitors for different concentrations follow the order: A≈C>B and the most excellent inhibition efficiencies respectively at 5mM and all studied inhibitors are mixed-type. In addition, the adsorption of the inhibitor molecules on the steel surface is reliable on the Langmuir adsorption isotherm model and the adsorption mechanism occurs through the combination of three aspects of interactions (physisorption, chemisorptions and retro-donation). IE% values of A, B and C inhibitors determined from EIS increase very slightly with temperature; the protective properties are excellent even at 55 C°. The investigative study is completed by a theoretical calculation of some quantum chemical parameters using the program Gaussian09. The EI order determined from the experimental measurements is successfully supported by the surface analysis and the obtained results confirmed an excellent agreement between the potentiodynamic polarization, weight loss, EIS and the theoretical study.

The second part was devoted to the nonlinear optical properties of benzylidenemalononitrile derivatives with different substituents of electron donating groups. Four benzylidenemalononitrile derivatives [benzylidenemalononitrile (**1**), (4-chlorobenzylidene)malononitrile (**2**), (4-hydroxybenzylidene)malononitrile (**3**) and (4-dimethylamino)benzylidene)malononitrile (**4**)] were functionalized, synthesized and analyzed by H¹ NMR, FT-IR and UV-vis. A study of the electrochemical properties was conducted using cyclic voltammetry. The third harmonic generation technique was used to analyze and evaluate the susceptibility ($\chi_{THG}^{<3>}$) of cubic nonlinear optical properties on thin films at 1064 nm. THG measurements using the Maker fringe technique were used to analyze and evaluate the susceptibility parameter $\chi^{<3>}$ of PMMA thin films with embedded molecules.

Keywords: Pyridinium salt, steel, electrochemical methods, weight loss, corrosion, benzylidenemalononitrile, cyclic voltammetry, THG.